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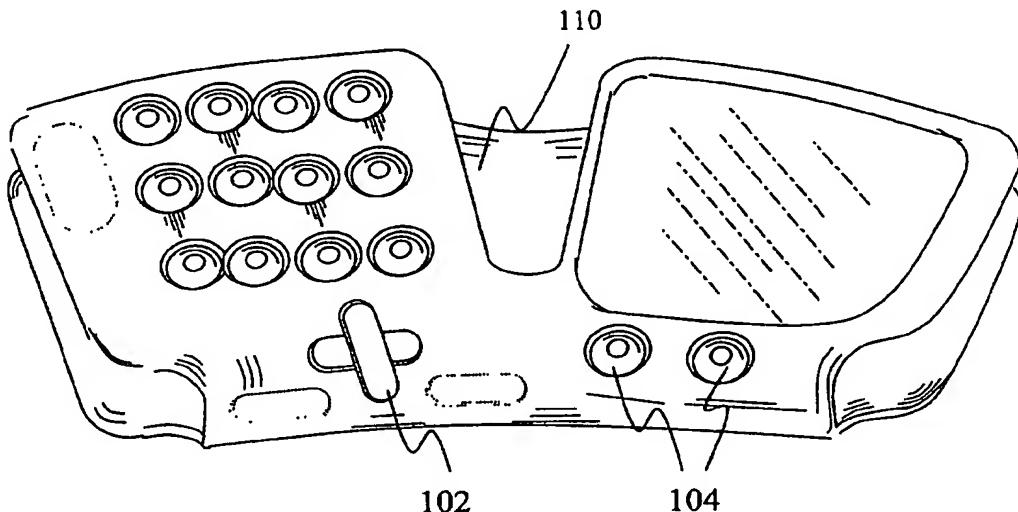
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[Continued on next page]

(54) Title: ADDING CONTROL KEYS TO MOBILE DEVICE VIA SMART INTERCHANGEABLE COVER



100

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(57) Abstract: An interchangeable cover is endowed with one or more control keys and complementary electronics to add the control keys to an attached mobile device, which may e.g. be a wireless mobile phone. In one embodiment, the control keys are designed to be used with an alternate display orientation of the attached mobile device. In one embodiment, the control keys are control keys of a game pad. In one embodiment, the cover is U-shaped. In a wireless mobile phone embodiment, the cover is attached to a rotatable sub-section of a pivotable section.



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**ADDING CONTROL KEYS TO MOBILE DEVICE VIA SMART
INTERCHANGEABLE COVER**

Related Application

- This application is a continuation-in-part application, claiming priority to
- 5 (a) U.S. Patent Application No. 10/087,098, filed 3/1/2002, entitled
“PERSONALIZING ELECTRONIC DEVICES AND SMART COVERING”, which
itself claims priority to its provisional filing no. 60/306,326, on 7/17/2001;
- 10 (b) U.S. Patent Application No. 09/932,154, filed 8/17/2001, entitled
“MOBILE ELECTRONIC DEVICE AND COVERING FOR SIMILAR DEVICES
WITH ORNAMENT ATTACHMENT MECHANISM”, which itself claims priority to
its provisional filing no. 60/292,123, on 5/17/2001; and
- 15 (c) U.S. Provisional Application no. 60/418,925, filed 10/15/2002, entitled
“Adding Control Keys to Mobile Device via Smart Interchangeable Cover”.

FIELD OF THE INVENTION

- 15 The present invention relates to the field of mobile devices. More
specifically, the present invention is related to adding control keys to mobile
devices, such as wireless mobile phones, personal digital assistants (PDA) and
so forth, via smart interchangeable covers.

BACKGROUND OF THE INVENTION

- 20 Advances in microprocessor and telecommunication technology have led
to wide spread deployment and adoption of mobile devices, such as wireless
mobile phones and PDA. For wireless mobile phones, in addition to wireless
telephony, the late models are often equipped with advanced capabilities, such
as calendar, address book, games, access to the World Wide Web (WWW),
25 emails, instant messaging, and so forth. Similarly, for PDA, in addition to
calendar and address book functions, the late models are often equipped with
advanced capabilities, such as wireless telephony, word processing,
spreadsheets, and so forth. In other words, for advanced models, there are
increasing cross over or convergent of the functionalities.
- 30 However, because of the compactness of the mobile device, typically only
limited number of control keys are available to operate these advanced
functionalities. For example, in the case of wireless mobile phones, typically only

a 12-key keypad plus a handful of control buttons are available, and in the case of PDA, only a handful of control buttons are available. As a result, usability and in turn the user experience of these advanced functions are poor, which in turn leads to the reduced acceptance of the advanced functions, removal of economic incentives for further development and introduction of the advanced functions.

- 5 Some prior art mobile devices support the provision of addition control keys, such as an alphabet keys, through the attachment of a peripheral device, such as a keyboard, to an I/O port of the mobile device. However, as described earlier, because of the inherit compactness of mobile devices, only limited
10 number of I/O ports, typically one, is available for attachment of external peripherals.

Thus, a need exists for an alternate more flexible approach to adding control keys to a mobile device.

BRIEF DESCRIPTION OF THE DRAWINGS

- 15 The present invention will be described by way of exemplary embodiments, but not limitations, illustrated in the accompanying drawings in which like references denote similar elements, and in which:

20 **Figure 1** illustrates a perspective view of an interchangeable cover incorporated with one aspect of the teachings of the present invention, in accordance with one embodiment;

Figure 2 illustrates another perspective view of the interchangeable cover of **Fig. 1**;

25 **Figure 3** illustrates a perspective view of the interchangeable cover of **Fig. 1** having been removably mated with a complementary core unit of a mobile device, in accordance with one embodiment;

Figure 4 illustrates an architectural view of the relevant electronic elements of the interchangeable cover of **Fig. 1**, in accordance with one embodiment;

30 **Figure 5** illustrates an architectural view of the mobile device of **Fig. 3**, in accordance with one embodiment;

Figure 6 illustrates the operational flow of the relevant aspects of the device driver of **Fig. 5**, in accordance with one embodiment;

Figure 7 illustrates a perspective view of an interchangeable cover incorporated with another aspect of the teachings of the present invention, in accordance with another embodiment;

- Figure 8** illustrates an exploded view of another mobile device, having an
5 interchangeable cover of a face plate type, incorporated with the teachings of the present invention, in accordance with another embodiment; and

Figures 9a-9c illustrate another mobile device, on which the present invention may be practiced, in accordance with yet another embodiment.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

10 The present invention includes an interchangeable cover equipped to add at least one control key to a mobile device.

Parts of the description will be presented in terms, such as mobile devices, control keys, interface, cover and so forth, consistent with the manner commonly employed by those skilled in the art to convey the substance of their work to
15 others skilled in the art. As well understood by those skilled in the art, the terms "mobile devices" as used herein, including in the claims, comprise wireless mobile phones, PDA, and other devices of the like. Similarly, the term "control keys", as used herein, including in the claims, comprises "control buttons", and other terms of the like.

20 The term "cover" as used herein refers to a part that inherently include multiple surfaces that cover at least multiple ones of the exterior surfaces of the body or core unit of a mobile device, where the exterior surfaces are inherently disposed in different geometric planes. Accordingly, while a "cover" may come in many variants, as illustrated by the description to follow, a "card" like part, i.e. a
25 part having the form factor of a "credit card", a PCMCIA card, a PC card, a Compact Flash card and so forth, is not a "cover", for the purpose of the present application. A "card" like part, for the purpose of the present application, by definition, is considered to occupy only one geometric plane.

In the following description, various aspects of the present invention will be
30 described. However, it will be apparent to those skilled in the art that the present invention may be practiced with only some or all aspects of the present invention. For purposes of explanation, specific numbers, materials and configurations are

set forth in order to provide a thorough understanding of the present invention. However, it will be apparent to one skilled in the art that the present invention may be practiced without the specific details. In other instances, well-known features are omitted or simplified in order not to obscure the present invention.

5 Various operations will be described as multiple discrete steps in turn, in a manner that is most helpful in understanding the present invention, however, the order of description should not be construed as to imply that these operations are necessarily order dependent. In particular, these operations need not be performed in the order of presentation. The phrase "in one embodiment" is used
10 repeatedly. The phrase generally does not refer to the same embodiment, however, it may. The terms "comprising", "having" and "including" are synonymous, unless the context dictates otherwise.

15 **Figure 1** illustrates an overview of the interchangeable cover of the present invention, in accordance with one embodiment. As illustrated, interchangeable cover 100 of the present invention is advantageously endowed with a number of control keys 102-104 and complementary electronics (see Figs. 2 and 4) to facilitate addition of control keys 102-104 to a complementarily equipped mobile device, to which interchangeable cover 100 is attached.

20 For the illustrated embodiment, control keys 102-104 comprise a control key 102 for facilitating a user of the attached mobile device to provide inputs to the attached mobile device along at least two axes, e.g. the X and Y axes, and control keys 104 to facilitate the user in providing two types of inputs.

25 For the illustrated embodiment, control keys 102-104 are disposed near different ends of an edge of the face surface of cover body 110 of cover 100. The disposition is designed to facilitate a user of the attached mobile device to provide inputs to an application that renders output on the display of the attached mobile device in a rotated manner (e.g. by approximately 90 degrees, from "normal" display orientation 302 to "rotated" display orientation 304, see Fig. 3). More specifically, the disposition is designed to facilitate substantial current
30 usage of control keys 102-104 with both hands of the user.

In gaming context, control key **102** may be a "joystick". Control keys **104** may be known as the A and B keys. In other words, in gaming context, control keys **102-104** form the control keys of a game pad.

In alternate embodiments, control keys may simply be extra function keys,
5 such as function keys **702** of **Fig. 7**, being added to the attached mobile device.

Still referring to **Fig. 1**, for the illustrated embodiment, cover body **110** of cover **100** has a substantially "rotated" U-shape or "taco shell" shape. Cover **100** is designed to attach to a core unit of a mobile device (such as the core unit of wireless mobile phone **300** of **Fig. 3**), in a side way manner (as denoted by arrow
10 **310** of **Fig. 3**). For the embodiment, cover body **110** has multiple surfaces occupying different geometric planes, and covers at least partially each of a front, a side and a back exterior surface of the core unit of phone **300**. For the embodiment, cover body **110** is designed to be snapped on to the core unit of a mobile device.

15 In alternate embodiments, cover body **110** may assume a body shape other than the illustrated "rotated" U-shape. Cover body **110** may also be designed to attach to a core unit of a mobile device in manner that is other than a side way manner. Similarly, cover body **110** may also be designed to attach to a core unit of a mobile device in a non-snapped on manner, even employing one or
20 more fasteners. A number of these alternate embodiments are further described later.

As illustrated in **Figure 2**, the complementary electronics of cover **100** are packaged as an application specific integrated circuit (ASIC) **202**. For the illustrated embodiment, ASIC **202** has output "pins" that are similar to the output
25 pins of embedded ASIC found in what's commonly referred to as "SIM chips". Further, ASIC **202** is disposed on the inside "side" surface of "rotated" U-shape body **110**.

Control keys **102-104** are coupled to ASIC **202** by way of traces disposed on the inside surfaces of "rotated" U-shape body **110**. In various embodiments, a
30 protective interior layer may be included with cover body **110** to protect the traces. The protective interior layer may be made of any one of a number of known suitable materials, such as plastics.

In alternate embodiments, ASIC 202 may employ output "pins" of other types. ASIC 202 may be disposed in other location or locations of cover body 110. Further, the complementary electronics may be "packaged" in other manners.

5 **Figure 3** illustrates a perspective view of cover 100 of the present invention, attached to a core unit of a mobile device. For the illustrated embodiment, mobile device 300 is a wireless mobile phone. In particular, mobile device 300 includes display 301, where an application may render displays in at least one of two orientations, "normal" orientation 302, and "rotated" orientation 10 304, as described earlier, and an expansion I/O interface (covered by cover 100).

The expansion I/O interface comprises contacts that are complementary to the output "pins" of ASIC 202. Further, the expansion I/O interface is disposed at a location on an outer surface of the core unit of mobile device 300 corresponding to the disposition location of ASIC 202 on cover body 110.

15 From the descriptions to follow, it shall be readily apparent to one skilled in the art that the present invention may also be practiced with other types of interfaces, as well as with other mobile devices, in particular, personal digital assistants.

20 **Figure 4** illustrates an architectural view of the relevant complementary electronics, in accordance with one embodiment. For the embodiment, the relevant complementary electronics 400 includes an analog-to-digital converter 402, storage unit 404, and input/output (I/O) interface 406, coupled to each other as shown.

25 Analog-to-digital converter 402 is employed to digitize the analog signals generated by control keys 102-104 as the user uses them to provide input to mobile device 300. Storage unit 404 is employed to store the digitized input data.

30 In various embodiments, storage unit 404 may be any one of a number of non-volatile memory known in the art, including but not limited to EEPROM, and so forth. In various embodiments, the storage locations of storage-unit 404 may be memory mapped into the memory space of mobile device 300.

I/O interface 406 facilitates an application or a system service of mobile device 300 in reading the inputs provided using control keys 102-104. As

described earlier, I/O interface **406** may be any one of a number of I/O interfaces known in the art.

Figure 5 illustrates mobile device **300** in further detail, in accordance with one embodiment. As alluded to earlier, for the illustrated embodiment, mobile device **300** is a wireless mobile phone; however, for other embodiments, mobile device **300** may be other mobile devices, including but are not limited to PDA.

As illustrated in Fig. 5, the core unit of wireless mobile phone **300** includes conventional elements, such as micro-controller/processor **502**, digital signal processor (DSP) **504**, non-volatile memory **506**, general purpose input/output (GPIO) interface **508**, radio receiver **510**, and transmit/receive (TX/RX) **512** (also known as a transceiver), coupled to each other via bus **514**, and disposed on a circuit board **520**.

The core unit of wireless mobile phone **300** is endowed with a software implementation of a device driver **534** in support of the electronics packaged in ASIC **202**. In various embodiments, the core unit of wireless mobile phone **300** is also endowed with game applications **532**. Further, game applications **532** may require, or operate more enjoyably, with added control keys **102-104**.

Except for device driver **534** provided to mobile device **300**, which relevant operating logic will be described more fully below, each of these elements **502-514** performs its conventional function known in the art, and is intended to represent a broad range of such element and its equivalents. In particular, GPIO **508** is configured to generate an interrupt notifying control processor **502** of data read from cover **100**, which in turn directly or indirectly causes an application of mobile device **300** to be invoked and process the data read.

Further, TX/RX **512** may be designed to support one or more of any of the known signaling protocols, including but are not limited to CDMA, TDMA, GSM, and so forth. Moreover TX/RX **512** may be implemented using separate transmitter and receiver.

Accordingly, elements **502-514** will not be further described.

As illustrated in Fig. 6, upon invocation, device driver **534** of mobile device **300** attempts to read the memory mapped storage locations of cover **100** (hereinafter, simply input buffer on cover **100**), block **602**. At block **604**, device

driver 534 determines if data were present and read. If no data were present and read, the process continues back at block 602.

However, if data were read, device driver 534 stores the data read in storage locations of memory 506 of mobile device 300 (hereinafter, simply, input buffer in mobile device 300), block 606. As alluded to earlier, device driver 534 further notifies processor 502, causing an application to process the data read, block 608. Thereafter, the process continues back at block 602 again.

Accordingly, data may be advantageously inputted for mobile device 300 using added control keys 102-104.

10

Alternate Embodiments

Figure 8 illustrates an alternate embodiment of the present invention. More specifically, Fig. 8 illustrates an exploded view of a mobile phone 800 having core unit 800b and cover 800a, endowed with the teachings of the present invention. Similar to mobile phone 300 of Fig. 3, core unit 800b of mobile phone 15 800 includes in particular, a number of input keys 802, display 804, expansion interface 806, and internal components similar to those of Fig. 5. As described earlier, the internal components are equipped with logic to enable the addition of control keys 832-834 to mobile phone 800, including enabling displays be rendered on display 804 in one of at least two orientations 808a-808b. Further, 20 core unit 800b includes a front and a number of side and end exteriors surfaces 810a-810e, disposed in different geometric planes.

Cover 800a is of a face plate type, having "cut outs" 822, to facilitate mating with core unit 800b. When mated, cover 800a covers at least front surface 810a and one of the side and end surfaces 810b-810e of core unit 800b. 25 As the embodiment of Fig. 1, cover 800a includes a number of control keys 832-834, such as game and function keys, and electronic component 836 having earlier described complementary logic, to add control/function keys 832-834 to mobile device 800.

Figures 9a-9c illustrate yet another embodiment of the present invention. 30 More specifically, Fig. 9a-9c illustrate three mated views of a mobile phone 900 having a core unit and cover 910, endowed with the teachings of the present invention. Unlike the earlier described embodiments, the core unit of mobile

phone **900** has a multi-section form factor comprising a first section **902** and a second section **904**, and the second section **904** is further comprised of at least two sub-sections **904a-904b**. The first and second sections **902-904** may pivot towards each other as denoted by direction arrow **906a** or away from each other
5 opposite to the direction denoted by arrow **906a**. Sub-section **904a** may rotate relative to sub-section **904b** as denoted by the directions denoted by arrows **906b-906c**. In other words, mobile phone **900** may be considered as an improved version of what is commonly referred to as “flip” phones.

Similar to mobile phones **300** and **800** of **Fig. 3** and **8**, the core unit of
10 mobile phone **900** includes in particular, display **908**, a number of input keys and expansion interface (covered by cover **910**), and internal components similar to those of **Fig. 5**. As described earlier, the internal components are equipped with logic to enable displays be rendered on display **908** in one of at least two orientations (see **Fig. 9a-9b** and **9c**). Thus, for the display orientation of **Fig. 9a-**
15 **9b**, sections **902-904** may be thought of as the “top” and “bottom” sections of mobile phone **900**, whereas for the display orientation of **Fig. 9c**, sections **902-904** may be thought of as the “right” and “left” sections of mobile phone **900**. As will be readily apparent from the remaining descriptions, by varying either the disposition of the input/control keys, and/or the manner cover **910** attaches to
20 section **904** of mobile phone **900**, sections **902-904** may also be configured as the “left” and “right” sections of mobile phone **900**. Further, section **904** of mobile phone **900** with which cover **910** is to mate, includes a front and a number of side and end exteriors surfaces, disposed in different geometric planes.

Cover **910** is of a type similar to cover **100** of **Fig. 1**, except
25 control/function keys **912-914** to be added to mobile phone **900** are disposed on a “back” surface of cover **910**. Similar to cover **100**, embedded component (not shown) with the supporting logic is also disposed on the inside of the “side” surface. As before, upon mating with mobile phone **900**, cover **910** covers at least partially a front surface and one of the side and end surfaces of section **904**.
30 For the embodiment, the “standard” input keys and the added control/function keys **912-914** may be made available for usage in conjunction with display **908**, by rotating sub-section **904a** as illustrated.

Conclusion and Epilogue

Thus, it can be seen from the above descriptions, a novel method for adding control keys to a mobile device, such as a wireless mobile phone or a PDA, via an interchangeable cover, have been described.

- 5 While the present invention has been described in terms of the foregoing embodiments, those skilled in the art will recognize that the invention is not limited to the embodiments described. The present invention can be practiced with modification and alteration within the spirit and scope of the appended claims. Thus, the description is to be regarded as illustrative instead of restrictive
- 10 on the present invention.

CLAIMS

What is claimed is:

1. An interchangeable cover comprising:
 - 5 a cover body to mate with a body of a mobile device, covering at least partially each of a plurality of exterior surfaces of the body of the mobile device, the exterior surfaces being disposed on different geometric planes;
 - at least one control key disposed on the cover body;
 - traces coupled to the at least one control key; and
 - 10 an electronic component coupled to the traces, and equipped to add the at least one control key as input/control keys of a mobile device to which the interchangeable cover is attached.
2. The cover of claim 1, wherein the cover body is U-shaped and designed to be attached to the mobile device from a side of the mobile device.
- 15 3. The cover of claim 1, wherein the cover is a face plate, with the cover body designed to be attached to the mobile device from a front of the mobile device.
4. The cover of claim 1, wherein the at least one control key comprises a control key to facilitate a user of the mobile device to provide input along at least two axes.
- 20 5. The cover of claim 4, wherein the at least one control key comprises a joystick.
6. The cover of claim 1, wherein the at least one control key comprises a plurality of game control keys of a game pad.
7. The cover of claim 1, wherein the at least one control key comprises an A
25 control key and a B control key of a game pad.

8. The cover of claim 1, wherein the at least one control key *comprises* a programmable function key.

9. The cover of claim 1, wherein the at least one control keys comprises a plurality of control keys, with a first and a second subset of the control keys
5 disposed at different ends of an edge of cover body, designed for substantially current usage by a user with both hands.

10. The cover of claim 1, wherein the at least one control keys are designed to be used with an alternate display orientation of the attached mobile device.

11. The cover of claim 1, wherein the electronic component *comprises* an
10 analog-to-digital (A/D) converter coupled to the traces, a storage unit coupled to the A/D converter and an input/output (I/O) interface coupled to the storage unit.

12. The cover of claim 11, wherein the storage unit *comprises* EEPROM. The cover of claims 1, wherein the mobile device *comprises* functionalities of at least a selected one of a wireless mobile phone and a personal digital assistant.

15 13. The cover of claim 1, wherein the at least one control key is disposed on a first exterior surface of the cover body, and the cover further comprises at least one other input keys disposed on a second exterior surface of the cover body.

14. The cover of claim 14, wherein the cover body is U-shaped, with the first and second exterior surfaces being disposed on the different sides of the U-
20 shape.

15. A mobile device comprising
a core unit including a plurality of input/control keys, at least one extension interface and a plurality of exterior surfaces disposed on different geometric planes; and

an interchangeable cover removably attached to the core unit, covering at least partially each of at least two of said plurality of exterior surfaces of the core unit, the interchangeable cover having at least one additional control keys and electronics, coupled to each other, with at least one aspect of the electronics 5 designed to mate with the at least one extension interface of the core unit to add the at least one additional control keys to the input/control keys of the core unit.

16. The mobile device of claim 16, wherein the interchangeable cover comprises a cover body that is U-shaped, and designed to be attached to the core unit from a side of the core unit.
- 10 17. The mobile device claim 16, wherein the interchangeable cover is a faceplate, designed to be attached to the core unit from a front of the core unit.
18. The mobile device of claim 16, wherein the at least one control key of the interchangeable cover *comprises* a control key to facilitate a user of the mobile device to provide input along at least two axes.
- 15 19. The mobile device of claim 19, wherein the at least one control key of the interchangeable cover *comprises* a joystick.
20. The mobile device of claim 16, wherein the at least one control key of the interchangeable cover *comprises* a plurality of game control keys of a game pad.
21. The mobile device of claim 16, wherein the at least one control key of the 20 interchangeable cover *comprises* an A control key and a B control key of a game pad.
22. The mobile device of claim 16, the at least one control key of the interchangeable cover *comprises* a programmable function key.
23. The mobile device of claim 16, wherein the at least one control keys of the 25 interchangeable cover comprises a plurality of control keys, with a first and a

second subset of the control keys disposed at different ends of an edge of the interchangeable cover, designed for substantially current usage by a user with both hands.

24. The mobile device of claim 16, wherein the mobile device comprises at least two display orientations, a standard and at least one alternate display orientation, and the at least one control keys are designed to be used with the alternate display orientation.
25. The mobile device of claim 16, wherein the electronics of the interchangeable cover *comprises* an analog-to-digital (A/D) converter coupled to the traces, a storage unit coupled to the A/D converter and an input/output (I/O) interface coupled to the storage unit.
26. The mobile device of claim 26, wherein the storage unit comprises EEPROM. The mobile device of claims 16, wherein the core unit comprises functionalities of at least a selected one of a wireless mobile phone and a personal digital assistant.
27. The mobile device of claim 16, wherein the core unit comprises a first and a second section with the second section having a first and a second sub-section where the second-sub-section is rotatable relative to the first sub-section, and the cover removably attaches to the second sub-section of the second section.
28. The mobile device of claim 16, wherein the at least one additional control key is disposed on a first exterior surface of the cover, and the cover further comprises at least one other input key disposed on a second exterior surface of the cover.
29. The mobile device of claim 30, wherein the cover body is U-shaped, with the first and second exterior surfaces being disposed on the different sides of the U-shape.

30. A wireless mobile phone comprising:
 - a core wireless telephony unit including a first and a second section with the second section having a first and a second sub-section, where the second-sub-section is rotatable relative to the first sub-section and includes a plurality of exterior surfaces disposed on different geometric planes; and
 - a cover including at least one input/control key, removably mated with the second sub-section covering the the second sub-section at least partially in each of at least two of said plurality of exterior surfaces of the second sub-section.
31. The wireless mobile phone of claim 32, wherein the first and second sections are pivotally coupled to each other.
32. The wireless mobile phone of claim 32 wherein said at least one input/control key comprises a plurality of input/control keys of a game pad.
33. The wireless mobile phone of claim 32 wherein said at least one input/control key comprises a programmable function key.

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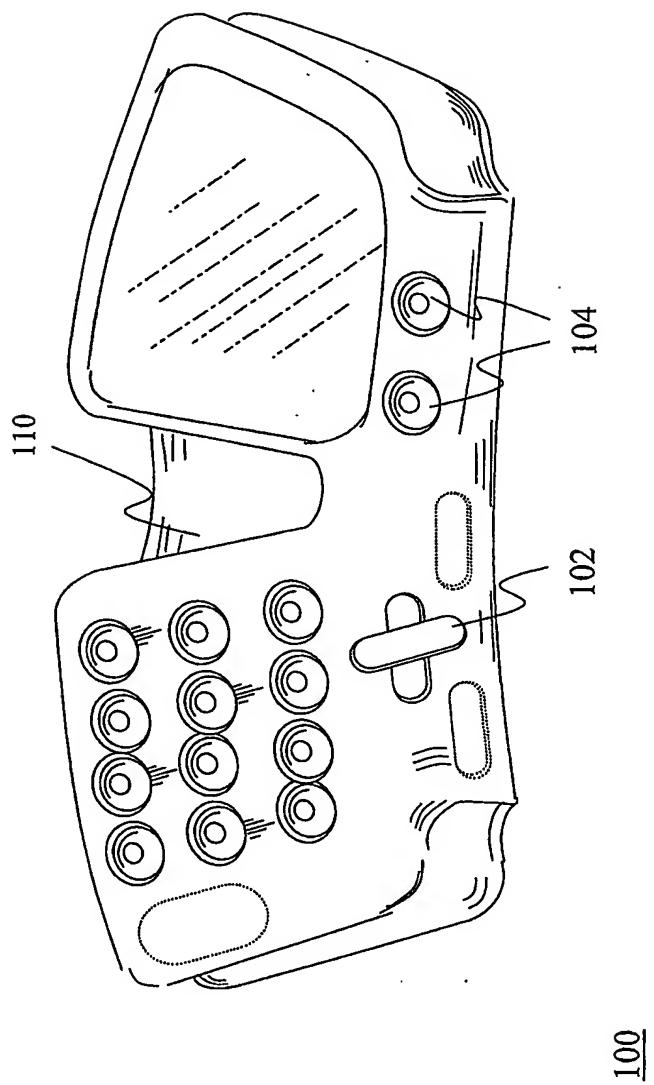


Figure 1

100

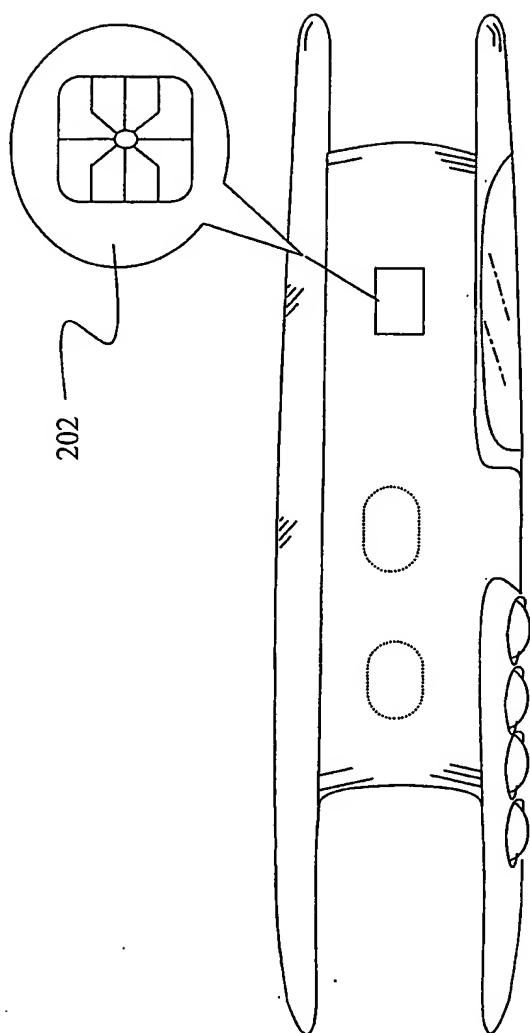


Figure 2

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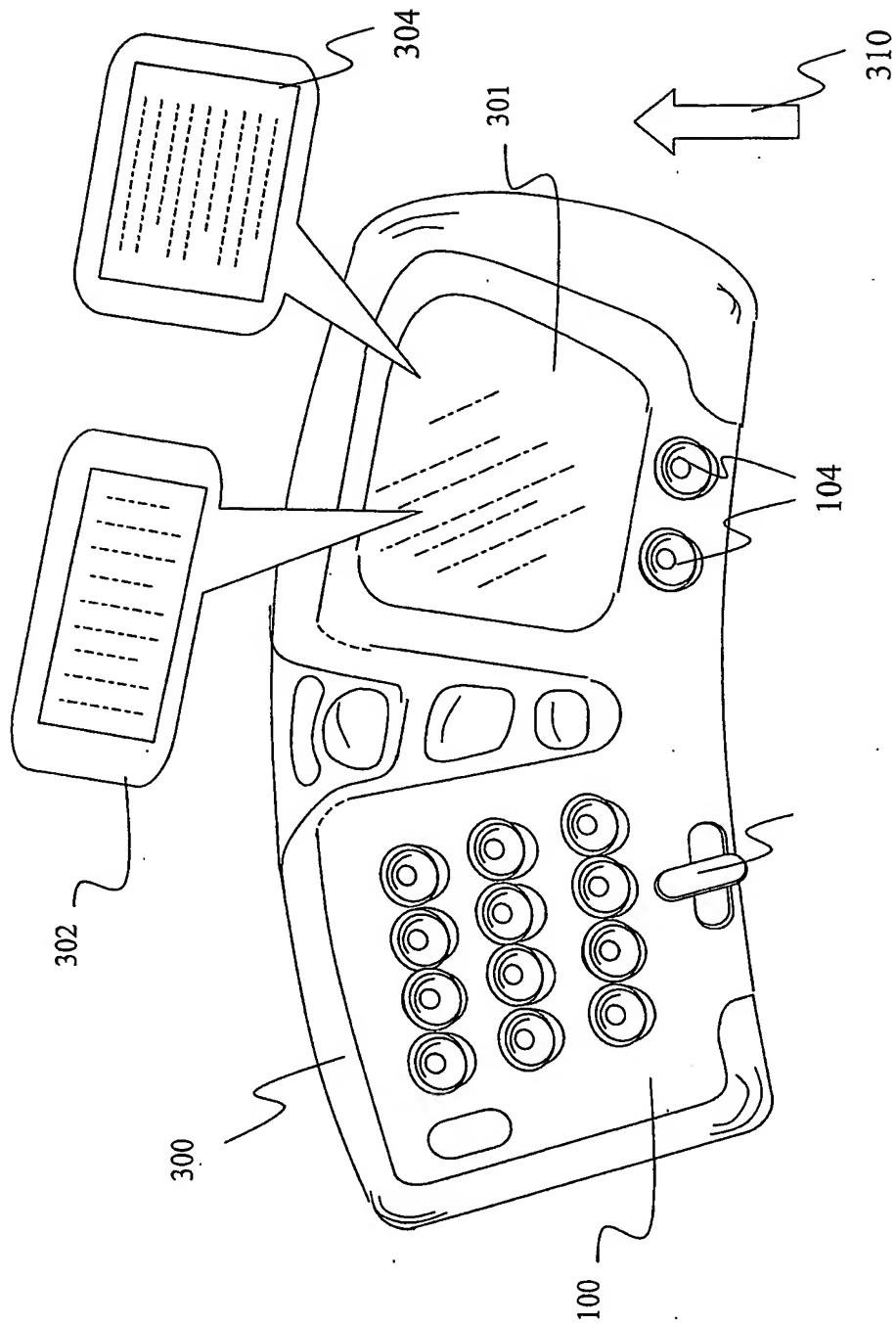


Figure 3

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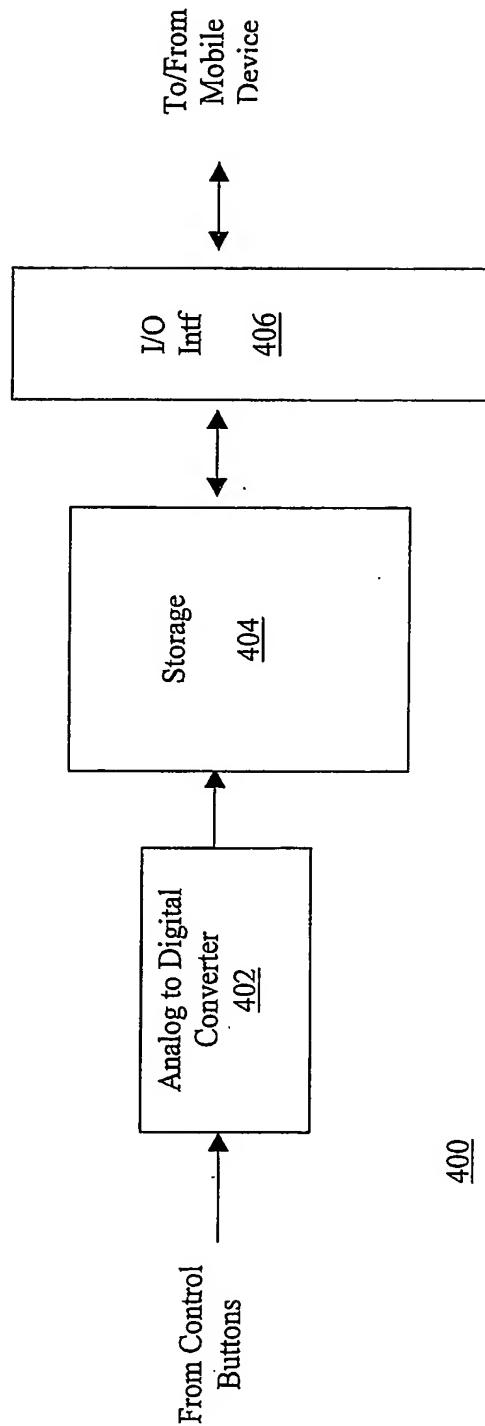
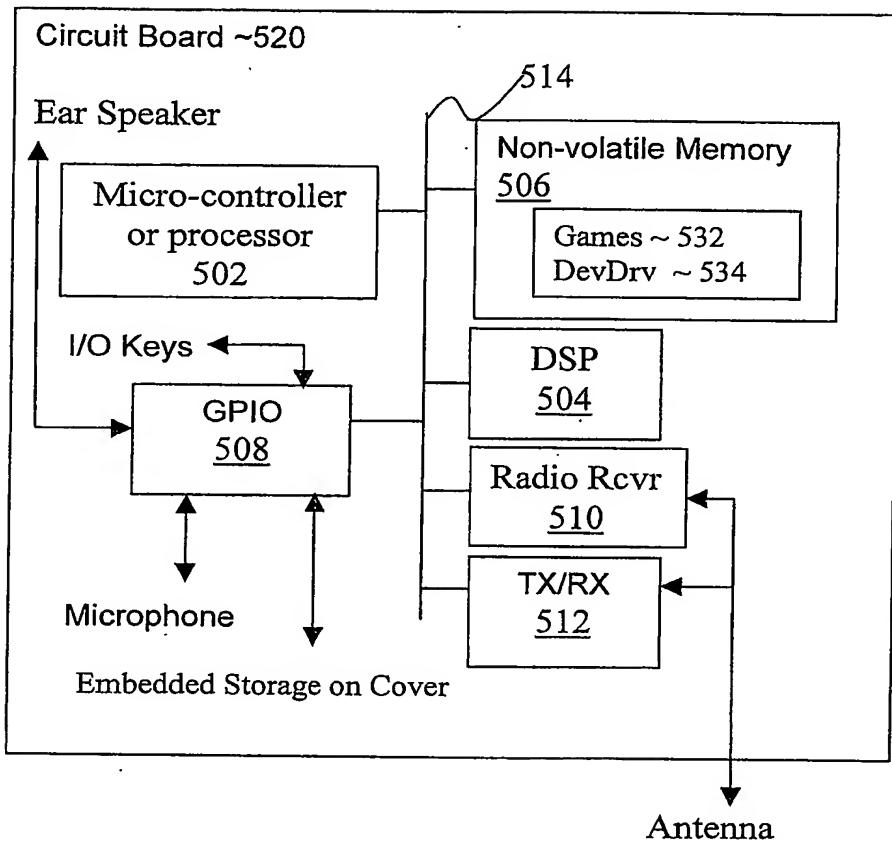
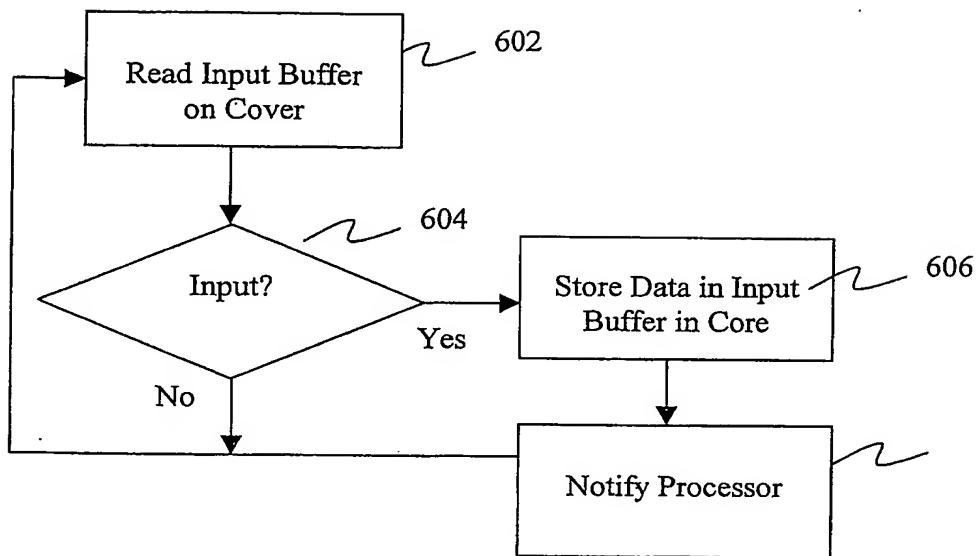


Figure 4

300**Figure 5**

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**Figure 6**

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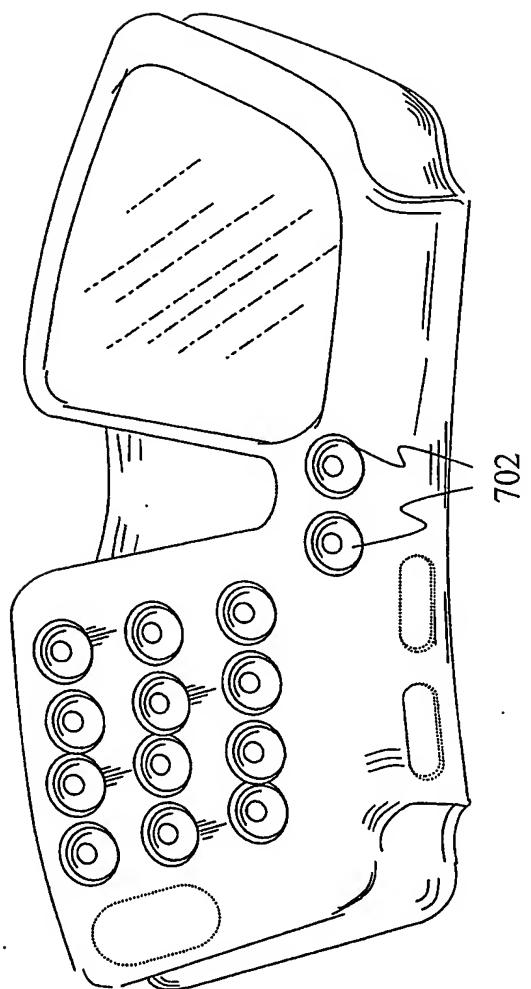
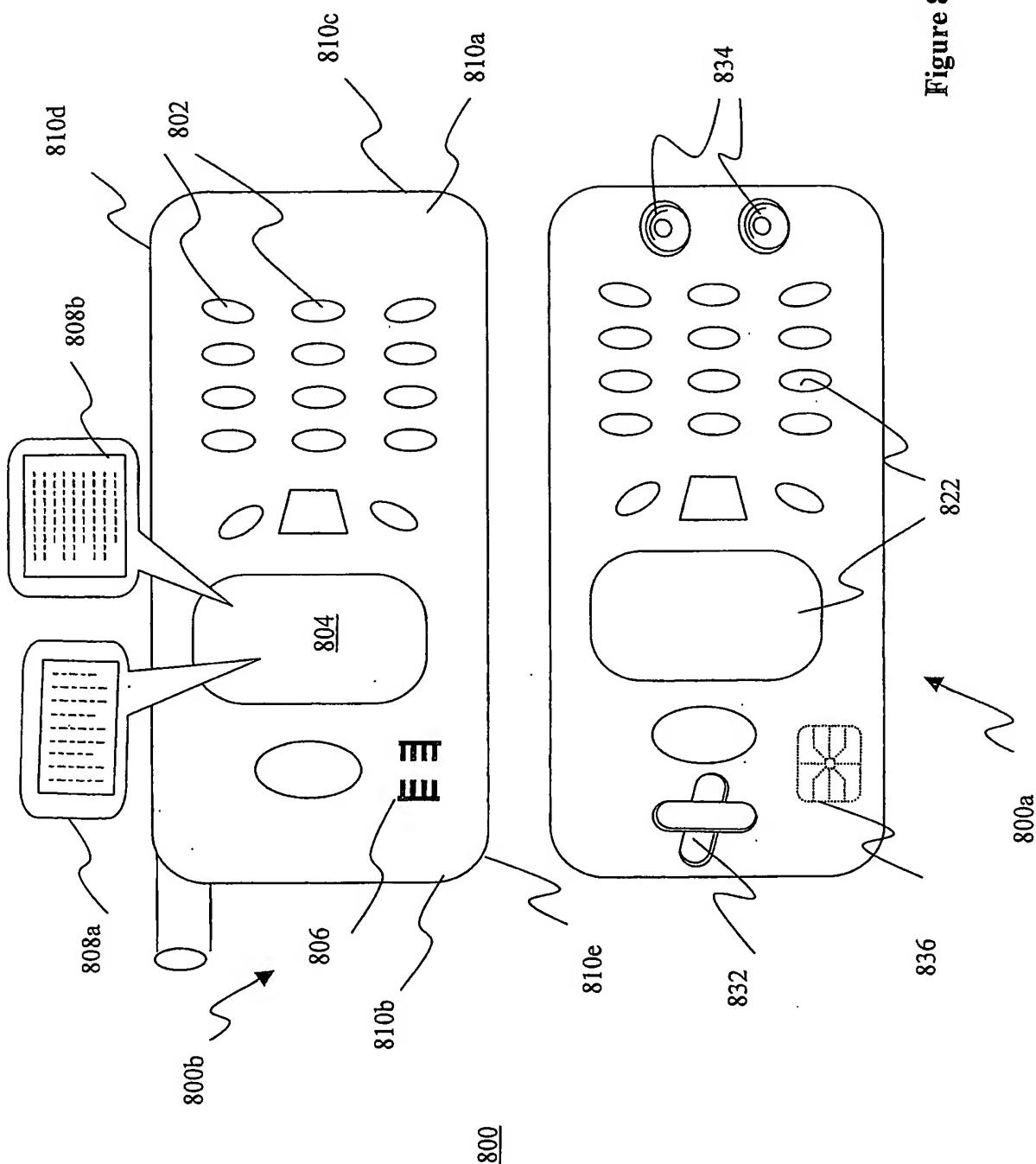


Figure 7

700

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